PATIENT SELECTABLE JOINT ARTHROPLASTY DEVICES AND SURGICAL TOOLS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. Ser. No. 11/671,745 entitled "Patient Selectable Joint Arthroplasty Devices and Surgical Tools" filed Feb. 6, 2007, which in turn claims the benefit of: U.S. Ser. No. 60/765,592 entitled "Surgical Tools for Performing Joint Arthroplasty" filed Feb. 6, 2006; U.S. Ser. No. 60/785,168, entitled "Surgical Tools for Performing Joint Arthroplasty" filed Mar. 23, 2006; and U.S. Ser. No. 60/788,339, entitled "Surgical Tools for Performing Joint Arthroplasty" filed Mar. 31, 2006.

U.S. Ser. No. 11/671,745 is also a continuation-in-part of U.S. Ser. No. 11/002,573 for "Surgical Tools Facilitating Increased Accuracy, Speed and Simplicity in Performing Joint Arthroplasty" filed Dec. 2, 2004, which in turn is a continuation-in-part of U.S. Ser. No. 10/724,010 for "Patient Selectable Joint Arthroplasty Devices and Surgical Tools Facilitating Increased Accuracy, Speed and Simplicity in Performing Total and Partial Joint Arthroplasty" filed Nov. 25, 2003.

Each of the above-described applications are hereby incorporated by reference in their entireties.

FIELD OF THE INVENTION

The present invention relates to orthopedic methods, systems and prosthetic devices and more particularly relates to methods, systems and devices for articular resurfacing. The present invention also includes surgical molds designed to achieve optimal cut planes in a joint in preparation for installation of a joint implant.

BACKGROUND OF THE INVENTION

There are various types of cartilage, e.g., hyaline cartilage and fibrocartilage. Hyaline cartilage is found at the articular surfaces of bones, e.g., in the joints, and is responsible for providing the smooth gliding motion characteristic of moveable joints. Articular cartilage is firmly attached to the underlying bones and measures typically less than 5 mm in thickness in human joints, with considerable variation depending on joint and site within the joint. In addition, articular cartilage is aneural, avascular, and alymphatic. In adult humans, this cartilage derives its nutrition by a double diffusion system through the synovial membrane and through the dense matrix of the cartilage to reach the chondrocyte, the cells that are found in the connective tissue of cartilage.

Adult cartilage has a limited ability of repair; thus, damage to cartilage produced by disease, such as rheumatoid and/or osteoarthritis, or trauma can lead to serious physical deformity and debilitation. Furthermore, as human articular cartilage ages, its tensile properties change. The superficial zone of the knee articular cartilage exhibits an increase in tensile strength up to the third decade of life, after which it decreases markedly with age as detectable damage to type II collagen occurs at the articular surface. The deep zone cartilage also exhibits a progressive decrease in tensile strength with increasing age, although collagen content does not appear to decrease. These observations indicate that there are changes in mechanical and, hence, structural organization of cartilage with aging that, if sufficiently developed, can predispose cartilage to traumatic damage.

For example, the superficial zone of the knee articular cartilage exhibits an increase in tensile strength up to the third decade of life, after which it decreases markedly with age as detectable damage to type II collagen occurs at the articular surface. The deep zone cartilage also exhibits a progressive decrease in tensile strength with increasing age, although collagen content does not appear to decrease. These observations indicate that there are changes in mechanical and, hence, structural organization of cartilage with aging that, if sufficiently developed, can predispose cartilage to traumatic damage.

Once damage occurs, joint repair can be addressed through a number of approaches. One approach includes the use of matrices, tissue scaffolds or other carriers implanted with cells (e.g., chondrocytes, chondrocyte progenitors, stromal cells, mesenchymal stem cells, etc.). These solutions have been described as a potential treatment for cartilage and meniscal repair or replacement. See, also, International Publications WO 99/51719 to Fofonoff, published Oct. 14, 1999; WO01/91672 to Simon et al., published Dec. 6, 2001; and WO01/17463 to Mannsmann, published Mar. 15, 2001; U.S. Pat. No. 6,283,980 B1 to Vibe-Hansen et al., issued Sep. 4, 2001, U.S. Pat. No. 5,842,477 to Naughton issued Dec. 1, 1998, U.S. Pat. No. 5,769,899 to Schwartz et al. issued Jun. 23, 1998, U.S. Pat. No. 4,609,551 to Caplan et al. issued Sep. 2, 1986, U.S. Pat. No. 5,041,138 to Vacanti et al. issued Aug. 29, 1991, U.S. Pat. No. 5,197,985 to Caplan et al. issued Mar. 30, 1993, U.S. Pat. No. 5,226,914 to Caplan et al. issued Jul. 13, 1993, U.S. Pat. No. 6,328,765 to Hardwick et al. issued Dec. 11, 2001, U.S. Pat. No. 6,281,195 to Rueger et al. issued Aug. 28, 2001, and U.S. Pat. No. 4,846,835 to Grande issued Jul. 11, 1989. However, clinical outcomes with biologic replacement materials such as allograft and autograft systems and tissue scaffolds have been uncertain since most of these materials cannot achieve a morphologic arrangement or structure similar to or identical to that of normal, disease-free human tissue it is intended to replace. Moreover, the mechanical durability of these biologic replacement materials remains uncertain.

Usually, severe damage or loss of cartilage is treated by replacement of the joint with a prosthetic material, for example, silicone, e.g. for cosmetic repairs, or metal alloys. See, e.g., U.S. Pat. No. 6,383,228 to Schmotzer, issued May 7, 2002; U.S. Pat. No. 6,203,576 to Afriat et al., issued Mar. 20, 2001; U.S. Pat. No. 6,126,690 to Ateshian, et al., issued Oct. 3, 2000. Implantation of these prosthetic devices is usually associated with loss of underlying tissue and bone without recovery of the full function allowed by the original cartilage and, with some devices, serious long-term complications associated with the loss of significant amount of tissue and bone can include infection, osteolysis and also loosening of the implant.

Further, joint arthroplasties are highly invasive and require surgical resection of the entire or the majority of the articular surface of one or more bones. With these procedures, the marrow space is reamed in order to fit the stem of the prosthesis. The reaming results in a loss of the patient's bone stock. U.S. Pat. No. 5,593,450 to Scott et al. issued Jan. 14, 1997 discloses an oval domed shaped patella prosthesis. The prosthesis has a femoral component that includes two condyles as articulating surfaces. The two condyles meet to form a second trochlear groove and ride on a tibial component that articulates with respect to the femoral component. A patella component is provided to engage the trochlear groove. U.S. Pat. No. 6,090,144 to Letot et al. issued Jul. 18, 2000 discloses a knee prosthesis that includes a tibial component